Two dimensional uniform kernel deconvolution

Bert van Es
Korteweg-de Vries Instituut, Universiteit van Amsterdam
email: a.j.vanes@uva.nl

In a general deconvolution model we have a sample of n independent X_i which are equal to the sum of independent and unknown Y_i and Z_i. So $X_i = Y_i + Z_i$. We assume that the Z_i have a known distribution. The aim is to estimate the probability density f of the Y_i from this sample of X_i.

Since the density of the observed X_i is equal to the convolution of the densities of the Y_i and Z_i one can derive a density estimator of f by Fourier inversion and kernel estimation of the density of the observations. This approach has proven to be useful in many deconvolution models, i.e. different known distributions of the Z_i. However, it fails in the model where the known density of the Z_i is uniform. This model is usually called uniform deconvolution.

We will present an alternative method based on kernel density estimation and a different, non Fourier, type of inversion of the convolution operator in this model. Following earlier work for the one dimensional model, cf Van Es 2002, we will use the same approach in the two dimensional model where the X_i, Y_i and Z_i are two dimensional random vectors and where the distribution of the Z_i is uniform on the unit square.

We will derive expansions for the bias and variance and present some simulated examples.

Reference [1] B. van Es. (2002) *Combining kernel estimators in the uniform deconvolution model* , ArXiv:math.PR/0211079.